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SOME OBSERVATIONS ON INTERNAL BROWN SPOT
AND VIRUS-LIKE SYMPTOMS OF YAM (DIOSCOREA SPP.)
IN THE COMMONWEALTH CARIBBEAN

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INTRODUCTION

'Internal brown spot' of yam (IBS) has been known to occur in Barbados in Dioscorea alata cv. 'White Lisbon' for the last ten years (Jeffers and Headley, 1967; Coursey, 1967). The condition is characterised by the presence of small brown nodules in the flesh of the yam tubers. These nodules are surrounded by normal white or creamy flesh, with no apparent connection with the outside. Spotted tubers are apparently indistinguishable from spot-free tubers unless they are cut open and examined. Internal brown spot of yam does not seem to be associated with pathogenic fungi, bacteria or nematodes (Iton, 1964; Mills, 1965; Edmunds, 1966). Harrison and Roberts (1973) reported that the tubers of yam (D. alata cv. White Lisbon) from Barbados affected by internal brown spot foliage showing mosaic/mottle symptoms. These leaves were found to contain two types of virus-like particles. The results also indicated that IBS is probably caused by a virus although the relationship between the virus-like symptoms on the foliage and IBS has not yet been established. The investigations reported here were carried out to determine the possible occurrence of IBS and virus-like symptoms on the leaves of other species of Dioscorea in addition to D. alata and their presence in other islands in the Commonwealth Caribbean.

RESULTS AND DISCUSSION

A. Observations on Dioscorea alata

(i) Distribution and occurrence of virus-like symptoms of yam foliage and IBS in yam tubers.

Results of a survey of 8 islands in the Commonwealth Caribbean during 1972/73 showed that virus-like symptoms (mosaic/mottle types) occurred on cultivars of D. alata in Trinidad, Grenada, Barbados, St. Vincent, St. Lucia, Dominica, Nevis and Jamaica. In a subsequent survey IBS was found to be present in all these islands.

(ii) Occurrence of IBS and virus-like symptoms on different cultivars of D. alata in Trinidad, Barbados and St. Vincent.

A survey of yam crops was carried out during November and December, 1973, to determine the incidence of virus-like symptoms on yam foliage. Two sampling methods were used. The first, employed in large-scale plantings (ca. 1-5 hectares), consisted of selecting 2-4 rows at random in each planting and recording the presence or absence of virus-like symptoms on every 5th plant along the rows. The second method, used in small plantings (under 1 hectare) consisted of recording presence or absence of symptoms on every plant occurring along the diagonals of each plot. A follow up survey during February, 1974 determined the incidence of IBS in the same plantings. Tubers were selected at random from yam storage piles and carefully sliced. Slices were cut as thin as possible (2-4 mm.) in order that small lesions were not overlooked.

IBS incidence was assessed as a percentage of tubers in the sample with IBS lesions. Size of the sample varied according to the amount of available material. Wherever possible, samples of 15-25 tubers were taken. The results are presented in TABLE 1.

(iii) Reaction of different cultivars of D. Alata to IBS growing under similar conditions in Trinidad and Barbados

During the survey of February 1974, information on the degree of IBS 'infection' of various D. alata cultivars was obtained. At three locations, two in Trinidad (U.W.I. Field Station, Champ Fleurs) and one in Barbados (Friendship Plantation, St. Lucy), D. alata cultivars had been growing in adjacent plots in more or less similar conditions. Samples of 10-20 tubers of each cultivar were selected at random and sliced as described earlier to determine percent IBS 'infection'. An infection index, the Spotting Index (SI), was calculated for each batch of tubers to assess the intensity of IBS 'infection'. SI was computed using the method of McKinney (1923) as follows:

$$SI = \frac{\sum \text{classes}}{N} \times \frac{100}{S}$$

where N = Total number of tubers sampled
S = Maximum spotting category

The classes of 'infection' are presented in Table 2 and the results of the survey are summarised in Table 3.

(iv) Occurrence of IBS under field conditions:

Most of the previous workers have recorded the occurrence of IBS in the tubers from yam storage piles. Coursey (1967) reported that during storage of the yam tubers, the spots enlarge and become more numerous. This observation gives the impression that IBS could be a storage disease. Therefore, it was planned to find out the possible occurrence of IBS under field conditions. Yam tubers infected with IBS were planted and 10 weeks before the normal time of harvesting samples of tubers were dug out at fortnightly intervals, sliced and examined. These observations revealed that the IBS becomes evident in the tubers of D. alata at least six weeks before the normal time of harvesting.

Observations on Dioscorea trifida

As Dioscorea trifida is not grown as commonly as D. alata in the Commonwealth Caribbean it was only possible to examine the former species in Trinidad and Grenada. In Trinidad, out of a total of 243 plants examined, 190 showed mosaic/mottle and 64 showed leaf distortion. In Grenada all 75 plants examined showed mosaic/mottle symptoms but no leaf distortion. Fifty tubers from plants showing foliage symptoms were sliced but IBS could not be found in any one of them. A more elaborate examination is needed to confirm the absence of IBS in D. trifida.

Observations on Dioscorea esculenta

As Dioscorea esculenta is also grown on a limited scale in the Commonwealth Caribbean, foliage and tubers of D. esculenta were examined in Trinidad and St. Vincent,

In Trinidad, out of a total of 100 plants examined, 95 showed mosaic/mottle symptoms and of these 9 showed leaf distortion. In St. Vincent all 80 plants examined showed mosaic/mottle only. Ten out of the 50 tubers of D. esculenta examined in St. Vincent showed IBS lesions while none were present in 125 D. esculenta tubers sampled in Trinidad.

A preliminary survey of yams carried out by Harrison (1972) in Barbados, St. Vincent and Trinidad indicated that mosaic and mottle symptoms of a virus-like nature occurred on D. alata, D. esculenta and D. trifida and that IBS was present in the tubers of D. alata, especially in the cultivar 'White Lisbon'. The present investigations confirm these observations and indicate that these disease symptoms are more extensively distributed in the Commonwealth Caribbean than was first reported (Jeffers and Headley, 1967). The present findings record the occurrence of IBS in the tubers of D. esculenta. Although IBS was observed in the field this, however, does not preclude the possibility of changes in IBS during storage as observed by Coursey (1967). As far as the authors are aware there are no reports of IBS occurring in any other part of the world.

The occurrence of both IBS and virus-like symptoms on species of Dioscorea other than D. alata suggests that a more complex disease situation may exist than was indicated by previous surveys. The various leaf symptoms observed on the three species may be caused by different viruses or alternatively, by strains of one virus. Harrison and Roberts (1973) reported the IBS-affected tubers of D. alata cv. 'White Lisbon', produced foliage with mosaic symptoms; such leaves contained two types of virus-like particles. Therefore, further work is needed to establish the relationship, if any, between different types of virus-like symptoms (Table 1) on D. alata and other species of Dioscorea and the IBS.

The results presented in Table 1 indicate that several cultivars of D. alata are affected by IBS and virus-like symptoms. Levels of 'infection' varied between cultivars of D. alata growing in similar location (Table 3). For instance, cvs. White Lisbon and Oriental were free of IBS in Barbados, even though other cultivars at the same location were affected. In contrast, these two cultivars were affected by the IBS at the Trinidad locations. The level of IBS in the planting material of these two cultivars in the two islands is not known but it is possible that the Barbados planting material was free of IBS. These results indicate the possibility of growing IBS-free tubers under field conditions.

Harrison and Roberts (1973) suggested that the bacilliform particle found in diseased yam plants probably belongs to the same major group of viruses as cacao swollen shoot and mealy bugs deserve attention as possible vectors. The authors have observed heavy infestations of mealy bugs in some storage piles of yam tubers. Further investigations to establish the nature of IBS and other virus-like conditions and their transmission are in progress at the University of the West Indies, St. Augustine, Trinidad.

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TABLE 1. Incidence of virus-like symptoms and Internal brown spot (IBS) in different cultivars of *Dioscorea alata* in Trinidad, Barbados and St. Vincent

Island/Location	Cultivar	% tubers with IBS	Mosaic/Mottled symptoms	Other virus-like symptoms
<u>Trinidad</u>				
U.W.I. Field Station	White Lisbon	70	+	+abc
	Seal Top ^e	-	+	+ ^b
	Oriental	20	+	-
	Ashmore	44	+	-
	Barbados	63	+	-
<u>Barbados</u>				
Thicket, St. Philip	White Lisbon	85	+	+ ^b
Sayes Court, Christ-church	Barbados	21	+	+ ^a
Chapel, St. Philip	Coconut Lisbon	90	+	-
Lancaster, St. James	Bottleneck	25	+	+ ^b
Graeme Hall, Christ-church	White Lisbon	0	+	+
<u>St. Vincent</u>				
Dauphine	White Lisbon	75	+	+ ^c
Camden Park	White Lisbon	35	+	-

* See Gooding (1960)

a Leaf Distortion

b Stunting of whole plant associated with chlorosis

c Vein Clearing

d Presence (+) or absence (-) of symptoms

e IBS not assessed in these plants

TABLE 2. Classes of Internal brown spot (IBS) 'infection' used in calculating the Spotting Index (SI)

Class	No. of Lesions/tuber	Class	No. of Lesions/tuber
0	0	5	21-30
1	1-5	6	31-50
2	6-10	7	51-90
3	11-15	8	91-170
4	16-20	9	>170

TABLE 3. Internal brown spot (IBS) 'infection' of some *D. alata* cultivars growing under similar field conditions at 3 locations in Trinidad and Barbados

Location	Cultivar*	% of tubers with IBS	S.I.
Trinidad, Site (1) ^a	Ashmore	44	5.6
	Barbados	63	8.3
	Smooth Statia	0	0.0
	White Lisbon	70	8.9
	Oriental	20	2.2
	Harper	44	8.3
	Seal Top	11	1.2
Trinidad, Site (2) ^a	Ashmore	10	1.1
	Bottleneck	30	3.3
	Moonshine	60	8.9
	White Lisbon	60	6.7
	St. Vincent Red	90	36.7
	Harper	100	20.0
Barbados,	Coconut Lisbon	70	21.1
Friendship, St. Lucy	White Lisbon	0	0.0
	Oriental	0	0.0
	Bottleneck	60	14.1

* See Golding (1960)

^a University Field Station, Champ Fleurs

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